



Era Aviation, Inc.

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## PROCESS SPECIFICATION

ERA AVIATION, INC.

GULF COAST DIVISION  
LAKE CHARLES, LOUISIANA

PROCESS SPECIFICATION NO. 2005  
FABRICATION OF THE PRIMARY SHELL AND CLOSURE PANEL  
FOR BK117 EXTERNAL FUEL SYSTEM



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FABRICATION OF THE PRIMARY SHELL AND CLOSURE PANEL  
FOR BK117 EXTERNAL FUEL SYSTEM

Prepared By:

Dave Murphy

Date:

8-9-96

Approved By:

Quality Control:

Dave Murphy

Date:

8-9-96

Engineering:

Peter A. Schwartz Jr.

Date:

8/12/96

Peter Schwartz Jr.

ERA PS 2005REV IRDATE 8/12/96**LOG OF REVISIONS**

REVISION	DATE	DESCRIPTION	APPROVED DATE
IR	8/12/96	INITIAL RELEASE	 T. B. Smith 8/12/96

ERA PS 2005REV IRDATE 8/12/96MATERIALS

<u>MATERIAL</u>	<u>NAME</u>	<u>MANUFACTURER</u>
Resin	Derakane 8084	Dow Chemical Midland, MI
	Derakane 470-36	Dow Chemical Midland, MI
Promoter	Cobalt Napthenate	AKZO Chemie New Brunswick, NJ
		OMC Mooney Chemicals Franklin, PA
Accelerator	Dimethylaniline	Buffalo Colors West Paterson, NJ
		Neste Fort Smith, AR
		Puritan Products Palmer, PA
MEKP Catalyst	Hi Point 90	Witco Chemical Richmond, CA
	Lupersol DHD 9	Lucidol Chemical Buffalo, NY
Mold Release	PVA	Rexco Carpenteria
		Costa Chemical Laguna Beach, CA
	Ceara Mold Release Wax	Ceara Products, Inc. Denver, CO
	Frekote 700	Dexter Corp. Seabrook, NH

ERA PS 2005REV IRDATE 8/12/96MATERIALSMATERIAL

UV Inhibitor

NAME

UV-9

MANUFACTURERIndustrial Chemicals  
Atlanta, GAGLS Fiberglass  
Goshen, INCook Composite & Polymers  
Port Washington, WI

Pigment

CoPlas pigment

CoPlas  
Fort Smith, AR

Spartan pigment

Spartan Pigments  
Houston, TX

Pigment

Neste  
Fort Smith, AR

Putty Filler

(Amorphous Fumed Silica)

Aerosil

Dequssa Corp.  
Teterboro, NJ

Cabosil

Cabot Corp.  
Boston, MA

Milled Fibers

731 ED

Owens Corning  
Anderson, S.C.

3/4 oz. type 'E' glass mat

M113-3/4 oz.  
or M127-3/4 oz.Certainteed  
Wichita Falls, TX

1 -1/2 oz. type 'E' glass mat

Compatamat- 1-1/2 oz.

PPG Industries  
Shelby, NCM113-1 1/2 oz.  
or M127-1 1/2 oz.Certainteed  
Wichita Falls, TX

Kevlar Woven Roving

K 49/051

Knytex  
Seguin, TX

ERA PS 2005REV IRDATE 8/12/96MATERIALSMATERIAL

Kevlar Woven Roving

NAME

285-F100

MANUFACTURERHexcel  
Chicago, IL

8.9 oz. type 'ECDE' glass

7781

Burlington Fibers  
Altavista, VA

10 mil 'C' glass

Modiglass

Reichold Chemical  
Bremen, OH

Manville glass

Manville Corp.  
Denver, CO

Superior glass

Superior Glass Fabrication  
Bremen, OH

10 mil 'C' glass

Regina Fiberglass

Regina Fiberglass Limited  
Liversedge, West Yorkshire

10 mil 'A' glass veil

Surglass

Superior Glass  
Bremen, OH

Paraffinated Styrene

TF-100

GLS Fiberglass  
Goshen, IN

Grinding Disks

36 Grit Type D  
60 Grit Type C  
80 Grit Type C3M Corp.  
St. Paul, MN

Mold Surface

Black Tooling Gel

Glidden

Gel Coat

Gel Coat

CoPlas  
Fort Smith, AR

Gel Coat

Neste  
Fort Smith, AR

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ERA PS 2005REV IRDATE 8/12/96

1. Inspect mold for defects (ie. chips, cracks, crazing, etc. ...) DO NOT proceed until any defect is corrected.
2. Assemble mold sections securely, as applicable.
3. Apply mold release agent (s) according to manufacturer's instructions.
4. Apply one layer of 1 1/2 oz. mat. Saturate with Derakane 8084 resin containing UV inhibitor (white pigment). Daeaerate with serrated rollers.
5. Apply one layer of 3/4 oz. chopped stand mat on mold surface. Saturate with Derakane 8084 resin containing UV inhibitor (NO pigment). Daeaerate with serrated rollers.
6. Apply one layer of Kevlar woven roving over entire mold surface. Saturate with Derakane 8084 resin containing UV inhibitor (NO pigment). Daeaerate with serrated rollers and plastic squeegees.
7. Apply 2nd layer of 3/4 oz. chopped strand mat over entire mold surface. Saturate with Derakane 8084 resin containing UV inhibitor (NO pigment). Daeaerate with serrated rollers.
8. Apply 2nd layer of Kevlar woven roving over the entire mold surface. Saturate with Derakane 8084 resin containing UV inhibitor (NO pigment). Daeaerate with serrated rollers and plastic squeegees.
9. Apply 3rd layer of 3/4 oz. chopped strand mat over entire mold surface. Saturate with Derakane 8084 resin containing UV inhibitor (NO pigment). Daeaerate with serrated rollers.
10. Apply 3rd layer of Kevlar woven roving over entire mold surface. Saturate with Daeaerate 8084 resin containing UV inhibitor (NO pigment). Daeaerate with serrated rollers and plastic squeegees.
11. Apply 4th layer of 3/4/ oz. chopped strand mat over entire mold surface. Saturate with Derakane 8084 resin containing UV inhibitor (NO pigment). Daeaerate with serrated rollers.
12. Allow laminate to exotherm and cool down.

ERA PS 2005REV IRDATE 8/12/96**LAYUP SEQUENCE FOR SEALING SURFACES**

13. Smooth any rough areas along the edges with 36 grit DA paper.
14. Apply a 4" wide 1 1/2 oz. type E glass mat over sealing surface area. Saturate with 8084 resin containing UV inhibitor (no pigment).
15. Apply a second 4" wide 1 1/2 oz. type E glass mat over sealing surface area. Saturate with 8084 resin containing UV inhibitor (no pigment).
16. Apply a third 4" wide 1 1/2 oz. type E glass mat over sealing surface area. Saturate with 8084 resin containing UV inhibitor (no pigment).
17. Apply 1 10 mil "C" glass over sealing surface area. Saturate with 8084 resin containing UV inhibitor (no pigment).
18. Bolt on upper surface mold to compress layup to predetermined thickness. Remove any excess resin before exotherm.
19. Drill all holes provided by drill guides in sealing surface tooling.
20. Remove tank shell and closure from molds.
21. Smooth down any roughness on inside flange of sealing surface to provide proper fit with closure.
22. Fill any voids with putty on outside of shell or closure. Allow to cure and dress up.
23. Spray all external surfaces with a contrasting coat of pigmented color.
24. Sand layup to contour tank with 36 grit grinding discs. Remove all surface pits using contrasting color to locate porosity areas (pin holes).
25. Fit closure to shell and make adjustments if required.
26. Write serial number of tank shell on the inside of shell and closure. Wax coat entire inner surfaces with 8084 resin containing paraffinated styrene including all drilled holes to insure complete isolation of Kevlar fibers.

ERA PS 2005REV IRDATE 8/12/96

## INSPECTION

It is the purpose of the inspection to verify that each part has been fabricated in accordance with and meets the requirements of this specification.

**RESPONSIBILITIES:** It is the responsibility of the fabricator to make available to Era Helicopter or his authorized representative any or all of the following:

Records: Records pertaining to the part(s) being purchased shall be supplied when requested. These may include:

- Materials specifications
- Equipment drawings or mold jig
- Materials test results.
- Dimensional verification reports.
- Rework and repair reports.

**MATERIALS:**

Raw materials used for laminates shall be virgin materials and shall be free of contaminants as described on pgs. 9-15.

**FABRICATED PARTS:** The part to be inspected shall be properly located and positioned, and shall be in condition to permit safe and thorough inspection. Reasonable means shall be provided to permit the inspector to visually examine the entire inner and outer surfaces of the part.

Allowable defects are listed on pg. 8.

The following inspection tools and equipment shall be made available for use by the inspector.

- Barcol harness tester.
- Acetone squeeze bottle with acetone.
- Extension cord with ground fault switch.
- A vapor tight inspection light.
- Thickness gauge.

ERA PS 2005

REV IR

DATE 8/12/96

## INSPECTION

### TEST OF FINISHED PARTS:

The following basic tests shall be included as a minimum in the Acceptance Inspection.

Barcol Hardness Test - A test of resin cure shall be made in accordance with ASTM D2583. Take 10 readings, discard highest and lowest, average the remaining readings. Minimum acceptable average reading is 30.

Surface Cure Test - An acetone test shall be used to detect surface inhibition on surfaces exposed to air during cure. The procedure that shall be used is the following: rub a few drops of acetone on the surface and check for tackiness after the acetone has evaporated. Persistent tackiness indicates incomplete cure.

Dimensions - The inspector shall be provided with copies of all approved drawings or mold jigs.

### OTHER APPLICABLE DOCUMENTS:

ASTM Standards

C 581-74-Test Method for Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures.

D 638-77a-Test Method for Tensile Properties of Plastics.

D 790-71-Test Methods for Flexural Properties of Plastics and Electrical Insulating Materials

D 883-78a-Definitions of Terms Relating to Plastics.

D 2583-75-Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

ERA PS 2005REV IRDATE 8/12/96

## ALLOWABLE DEFECTS

Defect	Surface Inspected
Cracks (through part)	None
Crazing (fine surface cracks)	Max dimension 1/2 in., max density 5 per sq. ft. min 2 in apart
Blisters (rounded elevations of the laminate surface over bubbles)	Max 1/4 in., dia x 1/8 in. high, max 1 per sq ft, min 2 in apart
Wrinkles and solid blisters	Max deviation, 20% of wall thickness but not exceeding 1/8 in.
Pits (craters in the laminate surface)	Max dimensions, 1/8 in dia x 1/16 in deep, max density 10 per sq. ft.
Surface porosity (pin-holes or pores in the laminate)	Max dimensions, 1/16 in dia. x 1/16 in deep, max density 10 per sq. ft.
Chips	Max dimension of break, 1/4 in., and thickness no greater than 20 percent of wall thickness, max density 1 per sq ft.
Dry spot (nonwetted reinforcing)	Max dimension, 2 sq in. per sq ft.
Entrapped air (bubbles or voids in the laminate)	1/8 in. max dia, 4 per sq in. max density; 1/16 in. max dia. 10 per sq. in. max density
Exposed Glass	None
Burned Areas	None
Exposure of cut edges	None
Scratches	Max length 1 in. max depth 0.010 in.
Foreign Matter	1/16 in. dia, max density 1 per sq ft

ERA PS 2005REV IRDATE 8/12/96

## FIBERGLASS SURFACING MAT

## 1.0 Scope

1.1 The scope of these procedures is to describe the visual, physical and mechanical parameters which characterize fiberglass surfacing mat used by the fabricator.

## 2.0 Definitions

2.1 Fiberglass Surfacing Mat - A random arrangement of glass fibers bonded with a binder to form a thin porous mat which is supplied in roll form. Surfacing mat is usually used to reinforce the corrosion resistant resin rich liner on the inside of equipment and to provide a smooth surface on the exterior of equipment.

2.2 Binder - Chemical treatment applied to the jackstraw arrangement of glass fibers to give the mat integrity. Specific binders are utilized to promote chemical compatibility with the various laminating resins used.

2.3 Slugs - Unfiberized beads of glass.

## 3.0 Requirements

3.1 Visual Requirements - Each roll of fiberglass surfacing mat shall be inspected to insure it is consistent in color, texture and appearance. Any holes, cuts or visual irregularities shall be removed from the mat prior to or during fabrication.

3.1.1 Slugs - Mat which contains more than four slugs per 100 lineal feet is rejectable.

3.1.2 Wrinkles - Crosswise wrinkles or waves that are visible at a 45 deg. angle and lengthwise wrinkles that can be readily flattened under pressure and that do not crease or change the dimensions of the mat are acceptable.

3.1.3 Wet Spots and Bar Marks - The mat shall be free from these defects.

3.1.4 Delamination - The mat shall not delaminate, i.e., shall not separate into layers in coming off the roll.

ERA PS 2005REV IRDATE 8/12/96

## FIBERGLASS SURFACING MAT

## 3.2 Physical Properties

3.2.1 Thickness - The thickness of the mat in each roll shall be measured.

3.3 Packaging Requirement - Packaging shall be visually inspected to assure proper labeling and that the package is free from damage that may render the mat unusable.

3.3.1 The mat shall be packaged in an unbroken carton as shipped from the mat manufacturer's factory. The mat used shall not be repackaged in the distribution of the mat after the manufacturer has shipped the mat.

3.4 Documentation - It is the responsibility of the fabricator to maintain records showing the results of all material testing. This information shall show at a minimum, the following:

- (a) Form of material
- (b) Manufacturer
- (c) Manufacturer's product description including binder type (treatment)
- (d) Manufacturer's product code
- (e) Production date, if available, or production code on carton.
- (f) Property measured and value recorded
  - \* Visual inspection
  - \* Width
  - \* Thickness
  - \* Packaging
- (g) Job number (Internal Fabricator Control Number)
- (h) Fabricated part identification number

ERA PS 2005REV IRDATE 8/12/96

## FIBERGLASS CHOPPED STRAND MAT

### 1.0 Scope

1.1 The scope of these procedures is to describe the visual, physical and mechanical parameters which characterize fiberglass chopped strand mat used by the fabricator.

### 2.0 Definitions

2.1 Chopped Strand Mat - Chopped strand mat is made from randomly oriented glass strands which are held together in mat form using a binder. Each strand contains a sizing.

### 3.0 Requirements

3.1 Visual Requirements - Each roll of chopped strand mat shall be inspected to insure it is consistent in color, texture and appearance. It shall be free from surface irregularities, fluffy masses, dirt spots or other foreign material; water spots, knots, binder spots larger than 2" in diameter, clumps of strands and tears of holes which may result from removal of defects.

### 3.2 Physical Requirements

3.2.1 Weight - The square foot weight of the mat shall be measured for each carton of mat used. All specimens shall fall within the range specified for the product.

3.3 Packaging Requirement - Packaging shall be visually inspected to assure proper labeling and that the package is free from damage that may render the mat unusable.

3.3.1 The mat shall be packaged in an unbroken carton as shipped from the mat manufacturer's factory. The mat used shall not be repackaged in the distribution of the mat after the manufacturer has shipped the mat.

3.4 Documentation - It is the responsibility of the fabricator to maintain records showing the results of all material testing. This information shall show at a minimum, the following:

- (a) Form of material
- (b) Manufacturer
- (c) Manufacturer's product description including binder type (treatment)
- (d) Manufacturer's product code
- (e) Production date, if available, or production code on carton.
- (f) Property measured and value recorded
  - \* Visual inspection
  - \* Width
  - \* Thickness
  - \* Packaging
- (g) Job number (Internal Fabricator Control Number)
- (h) Fabricated part identification number

ERA PS 2005REV IRDATE 8/12/96

## FIBERGLASS WOVEN ROVING

### 1.0 Scope

1.1 The scope of these procedures is to describe the visual, physical and mechanical parameters which characterize woven roving used by the fabricator.

### 2.0 Definitions

2.1 Fiberglass Woven Roving - Glass fiber rovings woven into a heavyweight fabric.

2.2 Warp Ends - The rovings which run in the longitudinal direction of the fabric, i.e., along the roll length of the fabric.

2.3 Fill Picks - The rovings which run in the transverse direction of the fabric, i.e., across the roll length of the fabric.

2.4 Leno Strands - A pair of warp ends at each edge of the woven fabric. One Leno warp end is always over each fill pick while the other Leno warp end is always under the fill pick. The Leno strands define the edges of the woven field and serve to stabilize the edges of the fabric.

### 3.0 Requirements

#### 3.1 Visual Requirements

3.1.1 Dirt Spots - Defined as all foreign matter, dirt, grease spots, etc. - The average number of dirt spots (1/16" to 3/4" in diameter) per 100 lineal feet shall be 6 or less. All rolls shall be free of dirt spots in excess of 3/4" diameter.

3.1.2 Warp Ends - All rolls shall be free of missing warp ends for more than two consecutive feet.

3.1.3 Fill Picks - All rolls shall be free of consecutive missing picks in excess of five, or more than eleven missing picks, either individual picks or any combination of individual and multiple (2, 3, 4, or 5) picks, in any consecutive 100 lineal feet.

3.1.4 Fuzz Clumps and Loops - The product is designed to exhibit proper laydown and shall be free of fuzz clumps or loops exceeding one inch in height from the surface.

ERA PS 2005REV IRDATE 8/12/96

## FIBERGLASS WOVEN ROVING

## 3.2 Physical Properties

3.2.1 Thickness - The thickness of the mat in each roll of woven roving shall be measured.

3.3 Packaging Requirement - Packaging shall be visually inspected to assure proper labeling and that the package is free from damage that may render the woven roving unusable.

3.3.1 The woven roving shall be packaged in an unbroken carton as shipped from the manufacturer's factory. The woven roving used shall not be repackaged in the distribution of the woven roving after the manufacturer has shipped the woven roving.

3.4 Documentation - It is the responsibility of the fabricator to maintain records showing the results of all material testing. This information shall show at a minimum, the following:

- (a) Form of material
- (b) Manufacturer
- (c) Manufacturer's product description including binder type (treatment)
- (d) Manufacturer's product code
- (e) Production date, if available, or production code on carton.
- (f) Property measured and value recorded

- \* Visual inspection
- \* Width
- \* Thickness
- \* Packaging

- (g) Job number (Internal Fabricator Control Number)
- (h) Fabricated part identification number

ERA PS 2005REV IRDATE 8/12/96

## KEVLAR WOVEN ROVING

## 1.0 Scope

1.1 The scope of these procedures is to describe the visual, physical and mechanical parameters which characterize kevlar woven roving used by the fabricator.

## 2.0 Definitions

2.1 Kevlar Woven Roving - Kevlar fiber rovings woven into a heavyweight fabric.

2.2 Warp Ends - The rovings which run in the longitudinal direction of the fabric, i.e., along the roll length of the fabric.

2.3 Fill Picks - The rovings which run in the transverse direction of the fabric, i.e., across the roll length of the fabric.

2.4 Leno Strands - A pair of warp ends at each edge of the woven fabric. One Leno warp end is always over each fill pick while the other Leno warp end is always under the fill pick. The Leno strands define the edges of the woven field and serve to stabilize the edges of the fabric.

## 3.0 Requirements

## 3.1 Visual Requirements

3.1.1 Dirt Spots - Defined as all foreign matter, dirt, grease spots, etc. - The average number of dirt spots (1/16" to 3/4" in diameter) per 100 lineal feet shall be 6 or less. All rolls shall be free of dirt spots in excess of 3/4" diameter.

3.1.2 Warp Ends - All rolls shall be free of missing warp ends for more than two consecutive feet.

3.1.3 Fill Picks - All rolls shall be free of consecutive missing picks in excess of five, or more than eleven missing picks, either individual picks or any combination of individual and multiple (2, 3, 4, or 5) picks, in any consecutive 100 lineal feet.

3.1.4 Fuzz Clumps and Loops - The product is designed to exhibit proper laydown and shall be free of fuzz clumps or loops exceeding one inch in height from the surface.

ERA PS 2005REV IRDATE 8/12/96

## KEVLAR WOVEN ROVING

## 3.2 Physical Properties

3.2.1 Thickness - The thickness of the mat in each roll of kevlar woven roving shall be measured.

3.3 Packaging Requirement - Packaging shall be visually inspected to assure proper labeling and that the package is free from damage that may render the kevlar woven roving unusable.

3.3.1 The kevlar woven roving shall be packaged in an unbroken carton as shipped from the manufacturer's factory. The kevlar woven roving used shall not be repackaged in the distribution of the kevlar woven roving after the manufacturer has shipped the kevlar woven roving.

3.4 Documentation - It is the responsibility of the fabricator to maintain records showing the results of all material testing. This information shall show at a minimum, the following:

- (a) Form of material
- (b) Manufacturer
- (c) Manufacturer's product description including binder type (treatment)
- (d) Manufacturer's product code
- (e) Production date, if available, or production code on carton.
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- (g) Job number (Internal Fabricator Control Number)
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